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(54) Name of the Invention Manufacturing Method for Substrate for Optical Recording Medium

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## Details of the Invention

### 1. Name of the Invention

Manufacturing Method for Substrate for Optical Recording Medium

### 2. Scope of Patent Claims

(1) What is claimed is a manufacturing method for producing optical data recording media substrate boards comprising a photosetting resin that is dripped onto both the surface of a substrate plate and on a stamper mold, which has a convexoconcave pattern; the stamper mold and resin substrate plate are superimposed in such a manner that the droplets come into contact with the same; pressure is applied to the points of contact and the droplets spread out over the surfaces; after being glued together, pressure is increased; and then ultraviolet light is made to shine on the photosetting resin causing it to harden.

(2) This is a manufacturing method for optical data recording media substrate boards as in claim 1 in which a transparent plate is exposed to an increase in pressure via a light transmission plate.

See Fig. 1  
- 2 drops  
coat -  
pressed to  
spread

See p. 3+4  
p. 5 - embodiment  
- resin dropped  
in center

drops  
resin  
UV  
Cure  
thin?  
10-sec

### 3. Detailed Explanation of the Invention

#### Field of the Invention

This invention is a manufacturing method for making substrate plates used as optical recording media for optical recording and reproduction of data.

#### Prior Art

Currently, there are a variety of cards such as credit cards, bankcards, clinic cards, etc. that contain embedded recording materials. These are primarily magnetic materials. The strong point of magnetic materials is that it is easy to write and read data. The disadvantages include the problem that the contents of the data can be easily changed, and high precision records are not possible. In order to solve these problems, there have been numerous reports that have dealt with this issue, and light cards are among the most important suggestions for optical data recording media.

Optical cards can be an important type of optical data-recording media. Generally, a laser light is used, which volatilizes parts of the data recording carrier. The data is recorded and reproduced by making changes that cause differences in the reflection rate or there is a change in form that causes optical changes in the reflection rate or transparency rate. In this case, when the data is written it is not necessary to have a development process. It is possible to have what is called a DRAW (direct read after write) media recording layer. It is possible to write additional data, as high precision data is possible.

The recording media can be metallic materials or pigments. From the standpoint of ease of handling, low cost, etc., it is the pigments that are generally used.

Figure 2a shows a schematic cross section diagram of an existing photo card media. In this figure, 1 is a transparent resin substrate plate; 2 is an optical recording layer; 3 is an adhesive layer; 4 is a protective plate; and 5 is a track groove. According to Figure 2, data recording and reproduction is performed by optically writing and reading in transparent substrate plate 1 and track grooves 5. Tracking can occur using the phasic difference of the laser light and the convexoconcave pattern of tracking groove 5.

In this method, the convexoconcave track grooves guide the recording and reproduction of the data, and the precision of laser beam tracking increases. High-speed access is possible when using a method employing a substrate with grooves. Also, it is possible to have a substrate plate in which the surface has been preformatted with tracking groove addresses, tracking groove addresses, start bits, stop bits, clock signal, error correction signals, etc.

Several current methods are known for transcribing the track grooves or preformatting from the stamper mold to the substrate plate. One method is the heat transcription method and employs a thermoplastic resin. The grooves are formed by exposing the resin to a temperature exceeding the melting point and then pressing, etc. Another method involves dripping a photosetting resin onto a substrate plate. Then the stamper mold is contacted. The side with the substrate plate is exposed to ultraviolet light energy. This is the aforementioned photosetting resin and hardening method (hereafter, referred to as the 2P process).

Of these methods, the method for heat etching of the stamper mold has certain defects. The equipment is expensive, the process is time consuming, and reproduction is not good.

Compared to this, the equipment cost for the 2P process is inexpensive, it can be done in little time, and reproduction is superior. From these points it is the most appropriate method for forming substrate plates with track grooves or preformatting.

#### **Problem that the Invention Solves**

However, the 2P process has problems as described below.

(1) It doesn't matter whether the resin is dripped onto the stamper mold or the transparent resin substrate plate. It is easy for bubbles to be formed in the hardened resin. These bubbles cause defects in the track grooves and preformatting layer, and this is a cause for gaps in the track guides.

(2) The thickness of the resin substrate plate is controlled. For example, if the thickness is less than the normal 2 mm, during the hardening of the photosetting resin, the substrate plate can become warped.

(3) The photosetting resin layer with the track grooves and preformatting may not be of uniform thickness.

It is the purpose of this invention to solve the aforementioned problems of the 2 P process so that it can be used to form track grooves and preformatting in the manufacture of the aforementioned optical data recording media substrates. The bubbles that were present during the process of forming the track grooves and preformatting disappear. Also, there is no warping during the formation of the track grooves. Moreover, the layer that was formed with the track grooves and preformatting is uniform in thickness.

#### **Procedure for Solving the Problem**

The special characteristics of this invention of a manufacturing method for optical data recording media substrate disks is that a photosetting resin is dripped onto both the convexoconcave pattern on the surface of the stamper mold and on the surface of the resin substrate plate. The stamper and the resin substrate plate are superimposed so that the drips come in contact with both in the same way. When the pressurized drips cover the surfaces completely, the surfaces are glued together. While in the pressurized state the photosetting resin is hardened with ultraviolet light.

Following are details of this invention based on the figures.

Figure 1, (a) through (c) summarizes an embodiment of this invention of the manufacturing method for an optical recording media substrate plate. In these drawings 1 is a transparent resin substrate plate, 8 is a photosetting resin, 7 is a stamper mold, 9 is UV light, 6 is a light transmission plate, and 10 is an optical card substrate with track grooves.

The object of this invention is a manufacturing method for optical data recording substrate plates by creating a pattern (such as track grooves or preformatting) on a transparent resin substrate plate 1. First, Figure 1 (a) shows a droplet of photosetting resin 8 on the surface of the transparent resin substrate plate 1 and on the convexoconcave surface pattern of stamper mold 7. Then, both of photosetting resin 8 droplets are evenly joined together by overlapping stamper mold 7 and transparent resin substrate plate 1. While under high pressure, transparent resin substrate plate 1 and stamper mold 7 are

12  
w/o dist. ment  
- 3x4x1

slowly joined so that as they are glued together, the point of contact of the droplets spreads across the surface.

Then, Figure 1 (b) shows the light transmission plate being used to apply high pressure to the transparent resin substrate 1. Then, while the pressure is still being applied, ultraviolet light 9 shines through transparent substrate plate 1 and hardens aforementioned photosetting resin 8. In the case when stamper mold 7 is not transparent, the ultraviolet light shines through the side with transparent resin substrate plate 1. Also, if the stamper mold is transparent, the light can shine through the side of stamper mold 7.

Next, Figure 1 (c) shows that after photosetting resin 8 has hardened, stamper mold 7 is removed. Then it is possible to obtain an optical card substrate plate 10 with tracking groove photo guides that has been transcribed from the convexoconcave pattern of stamper mold 7. The depth, width, precision, pitch interval, etc. of the track grooves on said optical card substrate plate 10 are dependent on the transcription conditions of stamper mold 7. Depending on the precision and care of the grooves on the stamper mold 7, the proceeding is a reliable method for manufacturing optical card substrate plates 10 with track grooves.

For this invention, it is best if there is more than one droplet of the photosetting resin dropped on the surface of the transparent resin substrate plate and on the surface of the stamper mold. Also, there must be an adequate total volume of resin of the droplets so that the resin can fill up the tracking grooves, preformatting or other pattern. The amount will differ depending on the size of the substrate plate, but as an example 0.01 to 1.0 milliliter is desirable.

For transparent resin substrate plate 1 that is used in this invention, it is desirable to use a material that can be optically recorded and reproduced with few imperfections, that has a high degree of smoothness, high transparency to the laser light that is used for recording and reproduction, and has low birefringence. Normal resins are used such as those used in plastic substrate plates and film. For example, acrylic resin, polyester type resins, polycarbonate type resins, vinyl type resins, polystyrene type resins, polyimide type resins, and polyacetal type resins, etc. These have a good transparency rate for laser light. Moreover, the acrylic type resins and the polycarbonate type resins have low birefringence. Moreover, it is desirable that transparent resin substrate plates be very smooth and have a thickness in the range of about 0.3 to 0.5 mm.

Light transmission plate 6 is used to protect the transparent resin substrate plate from waving and warping. It is desirable for the material to be smooth and transparent to ultraviolet light. Examples are BK7, quartz glass, etc.

Good materials to use for the photosetting resin utilized in this invention are the materials that are publicly known as suitable for the 2P process and that are sold commercially. It is desirable if transparency is not lost during molding and that the difference in the refractive index is within 0.05. It is also desirable that the said transparent resin substrate plate can be easily glued, and that the stamper mold can be easily detached. Good examples are epoxy acrylate type resins, urethane acrylate type resins, etc.

Also, it is desirable if stamper mold 7 of this invention has a convexoconcave pattern on the stamping surface. For example, a pattern of grooves, preformatting, or other pattern is etched or otherwise put onto a glass plate, quartz plate, or other type of transparent

best - more than 1 droplet on surf.

adequate total vol

plate. It is also possible to use, extra hard and [illegible] etc. metal that has been etched with a pattern of tracking grooves, preformatting, etc.

### Operation

In the existing 2P process, the photosetting resin is dripped onto only either the substrate plate or the stamper mold. However, it is easy for bubbles to remain when the substrate plate and the stamper mold become glued together. In the manufacturing process for making optical data recording substrate media plates of this invention, photosetting resin is dripped onto the convexoconcave pattern on the surface of the stamper mold and onto the surface of the substrate plate. The stamper mold and the substrate are superimposed so that the drops of resin come into contact with the same. Pressure is applied so that the contact points of the resin spreads out and the bubbles that were included disappear.

*spread resin*

Also, in this invention a light transmission plate is used to apply pressure to the substrate. It is used when the photosetting resin is being hardened can keep the substrate from warping.

### Embodiments

Following are concrete descriptions of embodiments of the invention.

#### Embodiment 1.

The substrate plate is made of polycarbonate and measures 150 mm in length, 150 mm in width and is 0.4 mm in thickness ("banraitō" 2H manufactured by Teijin Chemicals, Ltd.). The photosetting resin (0.3 ml), epoxy acrylate (30 x [illegible] OB2 or 082), manufactured by Three Bands Company) is dripped onto the upper surface in the center.

Also, the stamper mold is a strong plate measuring 150 mm in length, 150 mm in width and is 3 mm thick. The stamper mold has been etched with a convexoconcave pattern. To the center of the stamper mold is dripped 0.3 ml of photosetting resin epoxy acrylate (30 x [illegible] OB2 or 082) manufactured by Three Bands Company).

Next, the polycarbonate plate is superimposed over the stamper []. The two are gradually made to touch and be laminated. Also, above the polycarbonate substrate plate is placed a quartz glass plate that measures 150 mm in length, 150 mm in width and is 20 mm thick. A pressure device gradually increases the pressure on the resin plate until it reaches 200 kg/cm<sup>2</sup>. Then, the polycarbonate substrate plate is exposed through the quartz plate to ultraviolet light from a high-pressure mercury lamp (intensity of illumination 160 W/cm, distance 10 cm, time period 30 seconds). Next, the quartz glass plate is removed from the polycarbonate substrate plate, and the substrate plate is peeled off of the stamper mold producing a transparent resin substrate plate with tracking grooves.

*PT gradually*

As the bubbles that were in the transparent resin substrate plate have disappeared, the layer with the tracking grooves or preformatting does not have defects and there is no warping. Also, the photosetting resin layer in which the tracking grooves have formed has a uniform thickness of about 10 μm.

## Embodiment 2

The polycarbonate substrate plate is 150 mm long, 150 mm wide and 0.4 mm thick ("Pantoraito" 251, manufactured by Teijin Chemicals, Ltd.). In the center, on the top is dropped 0.3 ml of photosetting resin, epoxy acrylate (MRA201, manufactured by Three [illegible] Rayon).

... Also, the stamper mold is a quartz glass plate measuring 150 mm in length, 150 mm in width and is 3 mm thick. The stamper mold has been etched with a convexoconcave pattern. To the center of the stamper mold is dripped 0.3 ml of photosetting resin epoxy acrylate (MBA [illegible] 201 manufactured by Three [illegible] Company).

*dripped in center*

Next, the polycarbonate substrate plate is superimposed on the aforementioned subantaa mold. The two are gradually made to touch and be laminated. Also, above the polycarbonate substrate plate is placed a quartz glass plate that measures 150 mm in length, 150 mm in width and is 20 mm thick. A pressure device gradually increases the pressure on the resin plate until it reaches 200 kg/cm<sup>2</sup>. Then, the polycarbonate substrate plate is exposed through the quartz plate to ultraviolet light from a high-pressure mercury lamp (intensity of illumination 160 W/cm, distance 10 cm, time period 30 seconds). Next, the quartz glass plate is removed from the polycarbonate substrate plate, and the substrate plate is peeled off of the stamper mold producing a transparent resin substrate plate with tracking grooves.

As the bubbles that were in the transparent resin substrate plate have disappeared, the layer with the tracking grooves or preformatting does not have defects and there is no warping. Also, the photosetting resin layer in which the tracking grooves have formed has a uniform thickness of about 10 μm.

## Effect of the Invention

In the description above, in this invention the photosetting resin is dripped onto the surface of both the stamper mold and the substrate plate. At the points of contact the pressure is increased while the photosetting resin is hardened, which makes the bubbles that are included disappear. The pattern of tracking grooves or preformatting, etc. form without defect. AT does not have gaps, etc. and it is possible to use this manufacturing method to make the tracking grooves in optical data recording substrate plates.

Also, the substrate plates are smooth and transparent. While the pressure is being increased the photosetting resin is hardened so that the undulations and warping does not occur. The photosetting resin thickness is uniform.

## 4. Brief Explanation of the Figures

Figure 1 (a) through (c) shows simplified process drawings of an example of an embodiment of this invention for a manufacturing method for making optical data recording substrate plates. Figure 2 shows schematic cross sections of an existing optical card.

- 1-Transparent resin substrate plate
- 2-Optical recording layer
- 3-Adhesive layer
- 4-Protective plate

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- 5-Track groove
- 6-Light transmission plate
- 7-Stamper mold
- 8-Photosetting resin
- 9-UV light rays
- 10-Optical card substrate

Figure 1.

(a)

- 6 Light transmission plate
- 1 Transparent resin substrate plate
- 8 Photosetting resin
- 7 Stamper mold

(b)

- 9 Ultraviolet light rays
- 6 Light transmission plate
- 1 Transparent resin substrate plate
- 8 Photosetting resin layer
- 7 Stamper mold

(c)

- 10 Optical card substrate plate
- 8 Photosetting resin layer
- 1 Transparent resin substrate plate

Figure 2.

- 4 Protective plate
- 3 Adhesive layer
- 2 Optical recording layer
- 1 Transparent resin substrate plate
- 5 Track groove

C45

COPY

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⑩ 特許出願公開

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審査請求 未請求 請求項の数 2 (全5頁)

⑭ 発明の名称 光記録媒体用基板の製造方法

⑮ 特 願 昭63-173815

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## 明 加 書

## 1. 発明の名称

光記録媒体用基板の製造方法

## 2. 特許請求の範囲

(1) 凹凸パターンを有するスタンパー型の型面と基板の表面に光硬化性樹脂の液滴を置き、両液滴どうしが接触するようにスタンパー型と基板を圧合わせ、加圧して液滴を点接触状態を経て面状に拡げて密着させた後、加圧した状態で紫外線を照射して光硬化性樹脂を硬化せしめることを特徴とする光記録媒体用基板の製造方法。

(2) 透光性基板を介して基板を加圧する請求項1記載の光記録媒体用基板の製造方法。

## 3. 発明の詳細な説明

## 【産業上の利用分野】

本発明は、光学的に情報の記録・再生を行なう光記録媒体に用いられる基板の製造方法に関するものである。

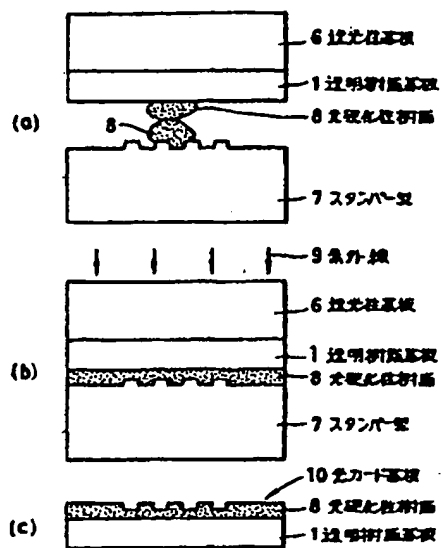
## 【従来の技術】

従来、クレジットカード、バンクカード、クリニックカード等のカード類に埋設される記録材料としては、主として磁気材料が用いられてきた。この様な磁気材料は、情報の書き込み、読み出しを容易に行なうことができるという利点がある反面、情報の内容が容易に変化したり、また高密度記録が出来ない等の問題点があった。かかる問題点を解決するために、多種多様の情報を効率よく取扱う手段として、光カードをはじめとする種々の光情報記録媒体が提案されている。

この光カードをはじめとする光情報記録媒体は、一般にレーザー光を用いて情報記録媒体上の一部を照射させるか、反射率の変化を生じさせるか、あるいは変形を生じさせて光学的な反射率または透過率の差によって情報を記録し、再生を行っている。この場合、記録層は情報の書き込み後、変換処理などの必要がなく、「書いた後に直読する」ことのできる、いわゆる DRAM (ダイレクト リード アフター ライト: Direct read after write) 媒体であり、高密度記録が可能で



第1図



第2図

